STS CONSULTANTS
750 Corporate Woods Parkway
Vernon Hills, Illinois 60061
847-279-2500 Phone
847-279-2510 Fax

November 17, 2004

Mr. Fred Micke, On-Scene Coordinator
US Environmental Protection Agency - Region 5
77 W. Jackson Blvd., SE-5J
Chicago, Illinois 60604-3590

RE: Revised Completion Report Addendum I for Lakeshore East Project, 221 N. Columbus Drive, Chicago, Illinois - STS Project No. 1-32193-XC

Dear Mr. Micke:

Enclosed please find an original and two copies of the revised Addendum and revised information for insertion into the Completion Report for the removal of radiologically-impacted soil at the Lakeshore East site. The Addendum was revised pursuant to the comments listed in the USEPA letter of November 2, 2004.

Please contact us with any questions you may have regarding this report or any other aspects of this project.

Sincerely,

STS CONSULTANTS, LTD.

Steven C. Kornder, Ph.D.
Project Manager

Douglas J. Hermann
Principal

Attachment: Completion Report Addendum I

STS CONSULTANTS
750 Corporate Woods Parkway
Vernon Hills, Illinois 60061
847-279-2500 Phone
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November 17, 2004

Mr. Fred Micke, On-Scene Coordinator
U. S. Environmental Protection Agency, Region 5
77 W. Jackson Blvd., SE-5J
Chicago, Illinois 60604

Re: Response to USEPA Review Comments dated November 2, 2004, Regarding the Completion Report (September 19, 2003) and Addendum (September 24, 2004) for Lakeshore East LLC, 221 North Columbus Drive, Chicago Illinois, STS Project No. 1-32193-XC

Dear Mr. Micke:

Attached please find an item-by-item response to your comments of November 2, 2004. Pursuant to our discussion of November 3, 2004 the revised Completion Report and Addendum pages will be submitted to the USEPA under separate cover for insertion into the original documents.

Please contact us at (847) 279-2500 with any questions you may have regarding the responses or any other aspects of this project.

Regards,

STS CONSULTANTS, LTD.

Steven C. Kornder, Ph.D.
Senior Project Geochemist

Douglas J. Hermann
Principal

cc: Kara Hughes, Lakeshore East LLC

Attachment: Comments

U.S. Environmental Protection Agency
STS Project No. 1-32193XC
November 15, 2004

RESPONSE TO USEPA COMMENTS -
FINAL CLOSURE REPORT AND ADDENDUM
LAKESHORE EAST LLC
STS Project No. 1-32193-XC

Lakeshore East LLC retained STS Consultants Ltd. (STS) to document mitigation of thorium-impacted fill material at the Lakeshore East Development located at 221 North Columbus Drive in Chicago, Illinois. STS submitted reports to the U.S. Environmental Protection Agency (USEPA) entitled *Completion Report Lakeshore East, 221 North Columbus Drive, Chicago, Illinois* dated September 19, 2003 and *Completion Report Addendum I Lakeshore East, 221 North Columbus Drive, Chicago, Illinois* dated September 23, 2004.

In its letter dated November 2, 2004 the USEPA provided comments to the above-referenced reports. STS Consultants Ltd. (STS) has reviewed the USEPA letter and has prepared a response to each of the USEPA comments (included below in bold).

1) **Volume I, page 1, Section 1.2 - Add "except in the southern slip where material potentially remains on site 174 feet west of the property along Harbor Drive and 109 feet north of the southern property line along 400 East Randolph as discovered on July 28, 2003, during wick drain installation. Additionally, as explained in Section 2.4, lift excavation surveys were not conducted in the slip areas and as a result the slip areas remain subject to institutional controls which require surveying in accordance with the Work Plan whenever soils are disturbed in the slip areas."**

Response:
An insertion (see underlined text below) into Sections 1.2 has been made pursuant to the above request.

Paragraph 2 of Section 1.2

The objective of the work described herein was to remove radiologically impacted soil to the cleanup levels specified by USEPA. With this demonstration that these cleanup levels have been achieved, it is requested that USEPA issue a Certification of Completion Letter, indicating that the site has been remediated of all identified radiologically impacted material. The only potential exception occurred in the southern slip where a small quantity of spoil from the installation of a wick drained was observed to have slightly elevated gamma level. The wick drain was located 174 feet west of the property line along Harbor Drive and 109 feet north of the southern property line along 400 East Randolph. The elevated gamma level is potentially attributed to ash and brick fragments within the spoil. A comprehensive discussion of the wick drain observations is provided in Section 2.3.3 of Addendum I to the Completion Report. Additionally, as explained in Section 2.4, lift excavation surveys were not conducted in the slip areas and as a result the slip areas remain subject to institutional controls which require surveying in accordance with the Work Plan whenever soils are disturbed in the slip areas at depths 18 inches below the ground surface.

2) **Volume I, page 7, Section 2.4 - Include the elevation in feet above mean sea level when referring to Chicago City Datum (CCD).**

Response:

A reference to mean sea level has been included on page 7 of Section 2.4 (0 feet Chicago City Datum = 579.48 feet mean sea level).

3) **Volume I, page 11, Section 2.9 - A notification to the City of Chicago regarding the material under the sidewalk should be added to this Section.**

Response:

A letter with an attached drawing showing the location and analytical results for the area beneath the sidewalk will be forwarded to the City of Chicago Department of Environment at the address listed below. A copy of the correspondence also will be forwarded to the USEPA.

Chicago Department of Environment
Attention: Ms. Rahmat Begum
30 North LaSalle Street, 25th Floor
Chicago, Illinois 60602

4) **Volume I, page 21, Section 6.2 - After the sentence-- "As a result, any excavation that may disrupt historical fill in those areas will require radiation monitoring of the excavation and appropriate management of any impacted soil encountered." Add the following sentence-- "This monitoring and management of impacted soils will be conducted in accordance with the Work Plan."**

Response:
The text has been modified pursuant to the above request.

5) **Volume I, page 21, Section 6.2 - The last sentence in the paragraph -- "The work completed under the Work Plan and as reported in this Completion Report, however, documents that no known impacted material remains, on site, either in the former slips or on the remainder of the site," should be changed to reflect that potential contamination may remain in the wick drain area in the southern slip and that lift excavation surveys, as described in Section 2.4, were not conducted in the slip areas. Change sentence to "The work completed under the Work Plan and as reported in this Completion Report documents that no known material remains on the site, except in the southern slip where material potentially remains on site 174 feet west of the property along Harbor Drive and 109 feet north of the southern property line along 400 East Randolph as discovered on July 28, 2003, during wick drain installation. Additionally, as explained in Section 2.4, lift excavation surveys were not conducted in the slip areas and as a result the slip areas remain subject to institutional controls which require surveying in accordance with the Work Plan whenever soils are disturbed in the slip areas."**

Response:
The Section 6.2 has been modified (underlined text below) to reflect the above comments as follows:

The work completed at the Lakeshore East site included obtaining verification sign off from USEPA for surveys of all of the areas on site where radiologically impacted soil had been identified. The removal of all identified impacted soil and the survey of those portions of the site where fill was sufficiently thick to shield potentially impacted soil from detection results in there being no areas on site where radiologically-impacted soil might remain, with the potential exception of at depths in the slips. Those areas formerly occupied by the slips (Figure 4) are sufficiently deep so as to preclude confirmation that no radiological material remains below the water table. As a result, any excavation that may disrupt historical fill in those areas will require radiation monitoring of the excavation and appropriate management of any impacted soil encountered. <u>The monitoring and management of impacted fill/soil will be conducted in accordance with the Work Plan.</u>

~~The work completed under the Work Plan and as reported in this Completion Report, however, documents that no known impacted material remains on site, either in the former slips or on the remainder of the site.~~ The work completed under the Work Plan and as reported in this Completion Report documents that no known material remains on the site, with the potential exception of a wick drain location in the southern slip where a small quantity of subsurface spoil (< 1 cubic foot) was observed to have slightly elevated gamma readings. As explained in detail in Section 2.3.3 of the Addendum to the Completion Report (STS, November 2004), it is possible that the elevated gamma readings were attributable to the ash and brick fragments present in the fill. The area is located a 174 feet west of the eastern property boundary along Harbor Drive and 109 feet north of the southern property boundary along 400 East Randolph. Additionally, surface gamma surveys were completed in the former slips areas, but lift excavation surveys were not conducted as explained in Section 2.4. Thus, the former slip areas remain subject to institutional controls that require surveying in accordance with the Work Plan whenever subsurface soils (below a depth of 18 inches) are disturbed in the former slip areas.

6) Volume 1, page 21, Sec 6.3 (c) - At the end of the sentence add ... except within the slip areas.

Response:
Since surface gamma surveys were completed within the slip boundaries, the last sentence of Section 6.3 will be modified by the addition of the phrase: "except were subsurface historical fill soils below a depth of 18 inches will be disturbed within the boundaries of the former slip areas."

7) Volume III, Appendix 1 - The USEPA data from the National Air and Radiation Environmental Laboratory (NAREL) has been received and will he sent to you under separate cover. This data must he included in Appendix I.

Response:
The USEPA data package will be converted into a PDF file format and copied to a CD. The CD will be included in Appendix D of the Addendum since the USEPA data package contains results for both the Completion Report and the Addendum which can not be easily separated. A page will be created for insertion into Appendix I of the Completion Report indicating that the data has been included in Appendix D of the Addendum.

8) Addendum 1, page 11 Section 4.1 - the sentence that states" . . . the objective of the project was to remove, material identified as radiologically impacted where feasible." Should be changed to be consistent with the objective stated in Volume I, page 1, Section 1.2. - "The objective of the work described herein was to remove radiologically impacted soil to the cleanup levels specified by U.S. EPA.

Response:
The first paragraph of Section 4.1 has been modified (see underlined text below) to reflect the objective as stated in Section 1.2.

In accordance with the Work Plan, the objective of the project was to remove ~~material identified as~~ radiologically-impacted ~~where feasible~~ soil to the cleanup levels specified by the USEPA. In early July, wick drains were installed to aid in the consolidation of the fill materials within the former southern slip. The installation of wick drains resulted in the generation of less than 1 cubic foot (ft^3) of spoil material per wick drain. Field survey personnel from Huber observed an elevated gamma reading of 27,000 cpm (versus a Ludlum/instrument specific cutoff value of 20,352 cpm based on the USEPA cleanup level of 7.1 pCi/g total radium) in the spoil at one of the wick drains on July 28, 2003. Figure 1 shows the position of the drain as 174 ft. west of the property line along Harbor Drive and 109 ft. north of the southern property line along 400 East Randolph.

STS CONSULTANTS, LTD.

Completion Report
Lakeshore East
221 North Columbus Drive
Chicago, Illinois

Volume I of III

STS Project No. 1-32193-XC
September 19, 2003
Revised November 17, 2004

STS CONSULTANTS, LTD.

Completion Report
Lakeshore East
221 North Columbus Drive
Chicago, Illinois

Volume II of III

STS Project No. 1-32193-XC
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Lakeshore East
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Lakeshore East LLC
One West Superior, Suite 200
Chicago, Illinois 60610

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Volume III of III

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STS CONSULTANTS
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Vernon Hills, Illinois 60061
847-279-2500 Phone
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AFFIDAVIT

Under penalty of law, I certify that, to the best of my knowledge, after appropriate inquiries of all relevant persons involved in the preparation of this report, the information submitted is true, accurate, and complete.

Steven C. Kornder, Ph.D.
Project Manager

4/18/04
Date

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FIGURES

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Appendix L	Equipment Release Survey Results
Appendix M	Film Badge Results
Appendix N	Shipping Manifests

Lakeshore East LLC
STS Project No. 1-32193-XC
September 19, 2003
Revised November 17, 2004

STS CONSULTANTS

COMPLETION REPORT
LAKESHORE EAST
221 NORTH COLUMBUS DRIVE
CHICAGO, ILLINOIS

1.0 INTRODUCTION

1.1 Work Completed in Accordance with USEPA Action Memorandum (July 17, 2002)

The work described in this Completion Report conducted in accordance with an Action Memorandum from U.S. Environmental Protection Agency (USEPA), dated July 17, 2002, entitled "Action Memorandum—Determination of Threat to Public Health or the Environment and Need for Time Critical Removal Action at the Family Golf Course/Lake Shore East Site Chicago, Cook County, Chicago, Illinois (Site Spill ID #05YH)". A copy of the Action Memorandum is included as Appendix A.

1.2 Work in Accordance with Approved Work Plan (September 30, 2002)

The work completed for this Completion Report was conducted in accordance with the Work Plan for Investigation and Removal of Radiologically Impacted Soil (Work Plan) prepared by STS Consultants, Ltd. (STS) dated June 24, 2002, revised September 13, 2002 and September 30, 2002, and approved by the USEPA in correspondence dated September 30, 2002. A copy of the Work Plan is included as Appendix B. A copy of the USEPA approval letter is included as Appendix C.

The objective of the work described herein was to remove radiologically impacted soil to the cleanup levels specified by USEPA. With this demonstration that these cleanup levels have been achieved, it is requested that USEPA issue a Certification of Completion Letter, indicating that the site has been remediated of all identified radiologically impacted material. The only potential exception occurred in the southern slip where a small quantity of spoil from the installation of a wick drained was observed to have slightly elevated gamma level. The wick drain was located 174 feet west of the property line along Harbor Drive and 109 feet north of the southern property line along 400 East Randolph. The elevated gamma level is potentially attributed to ash and brick fragments within the spoil. A comprehensive discussion of the wick drain observations is provided in Section 2.3.3 of Addendum I to the Completion Report. Additionally, as explained in Section 2.4, lift excavation surveys were not conducted in the slip areas and as a result the slip areas remain subject to institutional controls which require surveying in accordance

with the Work Plan whenever soils are disturbed in the slip areas at depths 18 inches below the ground surface.

1.3 Location and Description of Property, Proposed Development

The subject site consists of 25.18 acres located at the southwest corner of Wacker Drive and Lake Shore Drive, at 221 North Columbus Drive in Chicago, Illinois (Figure 1). The site is at approximately 41° 53' 40" North Latitude, 87° 37' 05" West Longitude, southwest ¼ of Section 10, Township 39N, Range 14E on the Chicago Loop, Illinois 7.5 Minute USGS Topographic Quadrangle Map.

The site is nearly flat topography at an elevation of approximately 590 feet above mean sea level (AMSL). This elevation is equivalent to approximately +10 feet Chicago City Datum (CCD). The site is bounded on the north by East Wacker Drive, currently occupied in part by a City of Chicago auto impound yard at ground level and Wacker Drive on an elevated viaduct. To the east is Lake Shore Drive. The south margin of the site is occupied by several residential high-rise buildings, East Randolph Street and commercial high-rise buildings. The west margin of the site is occupied by North Columbus Drive and commercial buildings. A small lake, a feature of the golf course that was formerly on the site, is located near the northwest corner of the site. The remainder of the site is vacant following removal of the golf operations. A Commonwealth Edison facility building is located on the adjacent property near the middle of the western side of the site, surrounded by a paved parking lot. Parcels O and P are located at the west end of the subject parcel and front on Columbus Drive to the west. Two buildings remain on Parcel P from the former golf operations, including a restaurant, clubhouse and office building and a maintenance shop, near the western end of the site. These two parcels, including the Commonwealth Edison property, are owned by other development parties and are not a part of this site for the purposes of this Completion Report. Figure 2 presents the site plan.

Proposed development will consist of residential townhouses and high-rise structures, with potential for some commercial development to be included. An approximately six acre city park with an elementary school is planned for the interior portion of the site. City streets are planned for the site surrounding the park and school and providing access to the existing roadways surrounding the site. Figure 3 presents the currently proposed site development plan.

1.4 Site History

The site and near vicinity was created as artificial or "made land" by infilling along the Lake Michigan shoreline, with much of the infill process taking place in the later half of the 19th century. Sanborn Fire Insurance Maps (Sanborn Maps) indicate the site was developed with rail lines, grain elevators, warehousing structures, coal and lumber yards and Shipping Slips C, D and E by 1891. Slip C was oriented north-south opening onto the Chicago River and Slips D and E were oriented east-west and opened to Lake Michigan. Figure 4 shows the locations of Slips C, D and E as they were depicted in 1906 on the subject site. The 1906 Sanborn Maps show similar structures and uses of the subject property consistent with those shown on the 1891 maps, except that much of the southern extent of Slip C had been filled by 1906.

Inspection of 1929 Chicago Aerial Survey oblique aerial photographs show the site was primarily a rail freight yard with warehouse storage facilities on the property. Slips C, D and E had been filled by the date of that aerial. Sanborn Maps from 1950, 1958 and 1962 indicate the site usage remained relatively unchanged with primary usage as rail freight yards, cold storage and general warehousing. Many of the warehouses from the 1906 Sanborn Maps had been razed. A 1980 aerial photograph indicates the commercial development of neighboring site properties, and only a few of the on-site rail lines remaining intact. The majority of the site is vacant in this photo, as most of the warehouses and other structures have been razed. A 1990 aerial photograph shows all the former site structures have been removed and North Lake Shore Drive has been reconfigured to its present-day location. The site is otherwise undeveloped. The site was developed as a golf course and practice range in 1994, and remained as such until the golf facility was closed for the implementation of the remediation conducted under the USEPA-approved Work Plan as documented herein.

1.5 Previous Phase I Investigations

Phase I Environmental Site Assessments were conducted on the subject property. These were provided to STS and were reviewed as part of the investigation of this property. These reports are:

> Dames & Moore, 1999, Updated Environmental Assessment (Phase I), 25-Acre Parcel SW Corner of Wacker and Lake Shore Drives, Chicago, Illinois: Rolling Meadows, Illinois, Job No. 44169-001-007, 15 p.

DAI Environmental, Inc., 2001, Phase I Environmental Site Assessment, Lakeshore East, 221 North Columbus Drive, Chicago, Illinois: Lake Forest, Illinois, Project No. 7230, 34 p.

1.6 Previous Radiological Surveys

This Completion Report addresses the removal of soil and fill materials that were found to be impacted with thorium and various radioactive decay progeny. The presence of elevated radioactivity was initially reported by USEPA in correspondence dated July 2, 2001, included as Appendix D. Subsequent investigations by STS are presented in the following reports:

- Radiation Survey, 26-Acre Site, Southwest Corner Wacker Drive and Lake Shore Drive, 221 N. Columbus Drive, dated September 19, 2001
- Addendum to Report for Results of Expanded Gamma Radiation Survey at 26-Acre Site, 221 North Columbus Drive, dated October 2, 2001
- Test pit Exploration at 26-Acre Golf Course Site, Southwest Corner of Wacker Drive and Lake Shore Drive, Dated January 8, 2002
- Final Report for the Lakeshore East Additional Radiation Survey Investigation, Dated February 8, 2002

These reports, referenced as Appendix E, comprise Phase I of the radiological work at this site, and document the presence of radiological impacts (elevated levels of total radium measured as radium 226 + radium 228) at several locations on site. (Note the distinction between the Phase I Environmental Site Assessment investigations referred to in Section 1.5, and Phase I of the radiological investigation, referenced herein.) Figure 5 shows the locations of the radiological impacts identified in these previous radiological Phase I investigations. It is noteworthy that the impacts occur only at locations within or immediately adjacent to the former locations of two of the shipping slips, Slips D and E.

1.7 Organization of Completion Report

Part 1.0 of this Completion Report presents the introduction and history of this site. Part 2.0 describes the activities that comprised the removal action. Part 3.0 documents the quantities of materials removed. Part 4.0 describes the difficulties encountered and the means by which those difficulties were resolved. Part 5.0 of this report presents the analytical results, including soil and air sampling, and both on-site and off-site laboratory analyses. Part 6.0 presents the conclusions of the report and requests a Completion Confirmation Letter from USEPA.

1.8 Resources (Costs) for Completion of Work

As of July 25, 2003, the Lakeshore East project has incurred nearly $3,042,000 in the completion of the Removal Action at the Subject Site. Additional costs may be incurred. Note that these costs do not include costs for disposal of radiologically-impacted soils provided through Kerr-McGee Chemical LLC and EnviroCare of Utah or USEPA oversight costs.

2.0 REMOVAL ACTION

The removal action consisted of two general phases which followed the initial site exploration and survey phase, Phase I, referenced above in Section 1.6. Phase II was the removal of the radiologically impacted material previously identified, as shown on Figure 5, and described below under Section 2.3. Phase III consisted of the radiological monitoring and, as needed, removal of impacted material detected during the general site grading. This work is described under Section 2.4.

2.1 Site Work Documented Through Weekly and Monthly Progress Reports

The work completed in the course of this removal effort was documented through weekly and monthly progress reports submitted to USEPA. These reports presented the work completed during the past week or month, and described the work planned to be completed in the coming week or month. The weekly reports also included the analytical results for the air sampling completed the previous week, both for the personal air monitors (PAMs) and for the perimeter air monitors. The analyses for the routine soil samples were not included in the weekly or monthly reports. The soil analyses for the verification analyses were submitted periodically with the request for USEPA sign off on successful remediation, and as a result were not also included with the weekly or monthly progress reports. The weekly and monthly reports are already on file with USEPA and are therefore not included as an attachment in this Completion Report.

2.2 Subdivision of Site (Slips D and E, Lift Survey Grids)

To document the work at the site, grid systems were established for the specific areas where the radiological impacts were initially detected within Slips D and E. Additionally, a grid system was established to cover the entire site to facilitate documentation of the lift surveys conducted during the general site grading operations. Figure 6 presents the grid systems for Slips D and E. Note that since no impacted material was identified as being associated within Slip C, an initial grid system for the Phase II remediation work was not established for Slip C.

The site-wide grid system is shown on Figure 7. This grid system, at 200 feet X 200 feet, was used to document the monitoring conducted during the general site grading phase, Phase III, described below in Section 2.4. The site-wide grid system was laid out consistently with the site-wide construction coordinate system. The site-wide grid, consisting of partial to complete grids 1 through 40, was further sub-divided

into 100 foot X 100 foot quarters, designated A through D, from the northwest quarter clockwise around to the southwest corner. Thus, the southeast quarter of grid 17 is designated 17C

2.3 Phase II Thorium Removal

The Phase II work consisted of removing the previously identified radiologically-impacted material to clean limits. The cleanup threshold established by USEPA was 5 picoCuries per gram (pCi/g) of total radium (Ra-226 + Ra-228) above the background radium activity, which was specified by USEPA as 2.1 pCi/g. Thus, the cleanup threshold for this site is 7.1 pCi/g total radium.

Removal consisted of establishing exclusion zones at each location where elevated radioactivity above the cleanup level was evident. The exclusion zones were marked with paint, and magenta and yellow radiation zone rope was used to delineate the perimeters. Entry into exclusion zones was limited to persons in proper personal protective equipment (PPE), in accordance with the approved Work Plan and Health and Safety Plan.

Removal began in the identified areas in Slip E, the south slip. Material was loaded directly into the shipping containers. Some of the excavations extended beyond the previously identified limits of the radiologically impacted materials. Figure 8 shows the limits to which the Phase II exclusion zones extended in order to reach clean limits.

In Slip E, one location exhibited radiological impacts that extended beneath the groundwater table. Additional exploration and documentation was required to demonstrate that all impacted material had been removed. That demonstration and discussion is described in Section 4.1.

Following remediation in Slip E, the removal effort moved to exclusions zones in and adjacent to the north slip, Slip D. Figure 8 shows the limits to which the Phase II exclusion zones in Slip D extended to reach clean limits. Several locations in Slip D also extended to depths slightly below the water table. However, the soils in Slip D at those locations were generally clay and provided sufficiently slow infiltration so as to allow the USEPA to conduct their verification surveys following completion of the removal.

2.4 Phase III Lift Surveys Radiological Screening and Removal

The topography of the site consisted of soil mounds that had been constructed as part of the golf course operations. While the site was at approximately the elevation it had been circa 1900, the presence of

these mounds provided sufficient cover so as to potentially shield from detection locations where radiologically-impacted material might be present above the 1900 elevation. The Lindsay Light facility operated in the vicinity in the early 1900s through approximately 1936. Thus, areas with fill above the 1900 elevation could have contained radiologically-impacted material from the Lindsay Light operations. As a result, those areas required surveying as they were excavated. Additionally, because soil of a sufficient thickness could provide shielding for material buried at that location, the excavations were conducted in lifts no thicker than 18 inches. Figure 9 shows those areas where fill soil was greater than 18 inches thick above the 1900 site elevation. These areas were the areas surveyed in the Phase III excavation survey effort.

The lift excavation surveys, Phase III, were done by excavating the mounded areas in the described 18" lifts. Surveying included both monitoring the area as it was excavated, and surveying the excavated spoil to confirm no radiologically-impacted material was encountered. The excavation was generally accomplished with a backhoe excavator, and the excavation spoil was moved and spread with a front-end loader.

This Phase III work was limited to the areas outside the slips. The slips were not included as they were filled after the 1900 date, and may have received radiologically-impacted fill to a depth below the site elevation in 1900. The Phase III excavations progressed in approximately 18 inch lifts to elevation 7.5 feet CCD[1] (7.5 feet CCD is equivalent to 586.98 feet Mean Sea Level (MSL)). This elevation is 18 inches above the approximate elevation of the site in 1900. In that Lindsay Light Company began operations after this date, the site elevation at that date limits the depth at which material may be disposed. The exception to this limitation is in the slips, which were filled between 1906 and 1929. Those slip areas are to be surveyed whenever excavation disturbs historical fill material that has not previously been surveyed.

Figure 10 notes those locations where material exceeding the cleanup threshold was encountered during the 18 inch lift surveys as part of Phase III. Those locations represent Phase III exclusion zones where the material was removed to clean limits, and USEPA provided verification sampling and sign off on each location.

2.5 Phase III Confirmation Sampling

Upon reaching the base of the excavated materials at elevation 7.5 feet CCD, samples were taken to confirm the radiological character of the soil. A set of five samples was taken and composited for each

[1] The relationship between Chicago City Datam (CCD) and Mean Sea Level (MSL) is: 0 ft CDD = 579.48 ft MSL.

100 foot X 100 foot square or part of a square. These samples were collected and analyzed in an effort to document the material at the base of the excavation. USEPA verification surveys were conducted where there had been documented evidence of material exceeding the cleanup threshold. The samples collected and analyzed from the base of the Phase III excavations were from areas where no exceedances were noted. As a result, no USEPA verification sampling was performed on those areas. These data document the absence of material above the cleanup threshold.

2.6 USEPA Verification Sampling

In the course of Phase II and III, radiological material exceeding the cleanup threshold was encountered. At each location an exclusion zone was established, and material was removed to clean limits. Upon reaching apparently clean limits and following a "pre-EPA survey and sampling" conducted by STS that showed the area met the cleanup standard, the USEPA was notified. The USEPA mobilized to the site and conducted verification surveys. The exclusion zones were surveyed in areas not exceeding 100 square meters. The areas were the same as the areas sampled as part of the "pre-EPA" survey and sampling effort, and were selected by the Field Team Leader and the Health Physics subcontractor.

Each 100 square meter area was surveyed by USEPA, and five sub-samples were collected from the approximate four quarters and the center of the area. In accordance with the Work Plan SOP-223, Verification Survey, the composite sample was homogenized, screened to minus ¼ inch, and five sub-samples were generated for radiological analysis. If the average of these five sub-samples was found to be less than the cleanup threshold of 7.1 pCi/g total radium, a successful verification form was prepared for USEPA signature, the supporting data and form were faxed to USEPA and upon receipt of the USEPA-signed form, the area was released for backfilling. The signed successful verification forms are provided in Appendix F.

2.6.1 Phase II Exclusion Zones

A total of approximately 17 exclusion zones were identified in the course of the Phase II removal effort (Figure 8). Several of the initially identified locations (Figure 5) coalesced as the excavations progressed. Several others were found as excavating equipment and truck traffic disrupted the soil and exposed shallow impacted material.

2.6.2 Phase III Exclusion Zones

Phase III surveys were limited to the areas outside the former slips. This survey effort found relatively few exclusion zones. All those found were in fairly close proximity to the former slips, and likely resulted from grading of material formerly in the slips. Figure 10 shows the locations of the exclusion zones located during the Phase III surveys.

2.7 Dust Control Measures

Concern for potential fugitive dust resulted in several efforts to limit the potential for dust generation. The Work Plan included a Dust Control Plan.

2.7.1 No Stockpiles

To the extent possible, the excavation and soil handling was done without generating or maintaining soil stockpiles. Of specific concern was the objective to not have any stockpiles of radiologically-impacted soil. All radiologically-impacted soil was loaded directly into shipping containers. In the course of the Phase III excavation, temporary stockpiles of unimpacted soil were generated as material was excavated prior to being spread. This material had been surveyed for radioactivity and found to be un-impacted prior to stockpiling.

2.7.2 Delay Clearing and Grubbing

The construction at the site included site clearing and grubbing (the removal of the vegetation and topsoil over the site). This effort was delayed until the completion of the Phase II removal effort and Phase III had been initiated. This delay assured that the areas known to be impacted remained covered with a vegetation cap as long as reasonably possible. Additionally, the maintenance of the grass cover limited the exposed soil areas which would be subject to wind erosion and dust generation.

When the clearing and grubbing was conducted, the areas were surveyed for radiological impacts following the removal of the topsoil cover. This was in effect, the initial survey of the Phase III 18 inch lift surveys.

2.8 Work Plan Changes

Two changes from the procedures specified in the Work Plan were requested in the course of the work effort. These changes are described in the following sections.

2.8.1 Downhole Exploration in Slip E

In Slip E, one location had radiologically impacted soil that extended beneath the water table. In the Phase I exploration, the downhole gamma log at boring number B-3 showed material exceeding the cleanup level at the bottom of the boring at a depth of 10.5 feet. In the course of remediation at location B-3, the soil removal extended to and beneath the groundwater table. After excavating approximately 3 to 4 feet below the water table, the inflow of water and the stability of the excavation sidewalls prevented the survey of the walls and floor to document whether the soil met the cleanup standard. In order to assess whether there was material remaining that exceeded the cleanup standard, a down-hole survey was conducted.

The excavation was backfilled with clean soil to slightly above the water level. Four 3-inch diameter steel casings were placed in 6-inch diameter boreholes drilled at the location of the suspect soil. The borings were then gamma surveyed in 6-inch intervals and the values compared to values indicative of material exceeding the cleanup threshold. The readings were corrected for the steel casing, the presence of the water in the soil and annular space around the casing, and for the separation between the wall of the boring and the casing. No values were found that exceeded the cleanup threshold. USEPA issued a letter dated February 11, 2003 indicating no material exceeding the cleanup standard was identified as remaining at this location and the area was cleared for backfilling (Appendix G). Figure 11 presents the locations of the four casings that were installed and surveyed as part of this verification effort.

2.8.2 Sub-Division of Site Regarding Parcels O and P

The initial surveys of the site under the Phase I work scope included all the property identified on Figure 2 out to Columbus Drive. Subsequently two of the westernmost parcels were acquired by other parties. The development of those parcels is likely to proceed independently from the remainder of the site. As a result, certain of the Work Plan tasks, such as the Phase III 18 inch lift surveys, were not completed on those parcels. It was requested that these parcels be addressed separately from the remainder of the site so as not to delay the preparation of this Completion Report. At present, USEPA is considering the

option of separating these parcels from the remainder of the site. Figure 12 shows the locations of these parcels at the west end of the site.

2.9 Impacted Materials Remaining Off-site Beneath Harbor Drive Sidewalk

At one location near the southeast corner of the site, removal of radiologically-impacted material extended to the property line. In the course of the removal effort, the excavation extended to and beneath the sidewalk adjacent to the site, along the west side of Harbor Drive at that location. At the risk of undermining the sidewalk, no further excavation was performed, and it was documented that some quantity of material exceeding the cleanup level is present beneath the sidewalk. This material is off the Lakeshore East site and is beneath the City of Chicago sidewalk right-of-way. Measurements of radioactivity for a sample from this location indicate material only slightly above the cleanup threshold of 7.1 pCi/g, with measured activity at 7.28 pCi/g. The approximate extent of the material exceeding the threshold is on the order of 15 to 25 feet along the north-south trending wall of the excavation. The material is on the order of 3 to 5 feet deep on the wall of the excavation.

Plastic sheeting and plywood sheets were placed against the excavation wall to minimize the potential erosion of the material. The extent to the east, underneath the sidewalk, was not explored by Lakeshore East as this material is off-site.

3.0 QUANTITIES OF MATERIALS REMOVED

3.1 Thorium-Impacted Soil

The Phase II removal and Phase III monitoring and removal efforts, completed March 7, 2003, resulted in identifying and removing 177 containers of radiologically impacted soil from the subject site. These containers were estimated at a unit weight of 20.53 tons per container based on the weights measured on previous removal efforts. A total of 3,633.8 tons were shipped as part of Phases II and III.

This material was transported for disposal to EnviroCare of Utah in Clive, Utah. Manifests for the shipping of this material are included in Appendix N.

3.2 Wood Waste and Rubble Removed

In the course of the thorium removal effort some debris was generated. This material included wood from the walls along the margins of the former slips, railroad bed ties, concrete debris from buildings formerly on site, as well as large concrete debris used in filling the former slips. The material was frisked for radioactivity. After demonstrating the debris was uncontaminated, the debris was staged for off-site disposal along with materials subsequently generated in the post workplan infrastructure and construction activities.

4.0 DIFFICULTIES ENCOUNTERED

4.1 Material Extending Below Water Table in Slip E

The removal in exclusion zone grid area E-H, 13-19 encountered radiologically-impacted material that extended below the water table (refer to Figure 11). The removal effort was thus constrained by several factors. First, material cannot be loaded into the shipping containers if it contains free standing water because the receiving landfill prohibits disposal of liquids. Thus, the material excavated from below the water had to be temporarily staged on the slope of the excavation to allow the water to drain. Second, the water provides some shielding as well as limiting how close the detector probe can be to the soil, thus reducing the sensitivity with which a determination can be made of whether the material is clean. Additionally, the water makes the side slopes of the excavation less stable, resulting in slumping of material into the excavation.

Upon excavating to what appeared to be clean limits, a revision in the verification method was developed and accepted by USEPA. This method consisted of backfilling the excavation with clean fill, installing 3-inch diameter steel well casings and conducting downhole gamma logging in the area where the suspect material had been removed. Following a series of calculations to correct for the shielding of the water and the annular space of the borings into which the casings had been installed, USEPA concurred that there were no exceedances of the cleanup criteria evident in the downhole data and the exclusion zone was released for backfilling. USEPA correspondence regarding this issue is included in Appendix G.

4.2 Material Extending Off Site Beneath Harbor Drive Sidewalk

At one location, radiologically impacted material was encountered that extended to and beyond the property boundary. Near the southeast corner of the site, along the west side of Harbor Drive, soil exhibiting gamma counts above the cleanup threshold was detected at the property line. Figure 13 shows the location beneath the Harbor Drive sidewalk where material was detected off-site. An effort was made to see if that material could be removed by extending the excavation slightly off-site. However, it became evident that while the measured levels were not high, the continued excavation would potentially undermine the sidewalk. As a result, the excavation side-wall was draped with plastic sheeting and covered with plywood. The length of the zone of material above the cleanup threshold was marked in spray paint along the west edge of the sidewalk. It was not determined how far the impacted material may extend to the east beneath the sidewalk. A sample of the material from the wall of the excavation

under the sidewalk measured 7.28 pCi/g. It is not intended as part of this remediation effort to remove this material, as it is off-site in the City of Chicago right-of-way.

4.3 Areas Where No 5-Meter Grid Survey Data Collected

The initial investigation phase, Phase I, consisted of a 5-meter grid survey of the entire approximately 26 acre Lakeshore East site (STS reports dated September 19, 2001; October 2, 2001). That data was used, along with down-hole radiation survey data (STS report dated February 8, 2002) to identify the locations to be remediated during Phase II.

In reviewing the data for this report, two areas were found to not be covered by the 5-meter grid survey data. The golf course lake continues to be filled with water which effectively precludes conducting of a walkover gamma survey. It is proposed to complete that survey when the lake is drained and the bottom has sufficient time to dry to make the survey feasible. The second area was covered with seasonally ponded water during the time the 5-meter survey was conducted. That location was near the west end of the driving range portion of the former golf operations. This second area was subsequently determined to be at an elevation that did not require lift excavations, as it was at or below the 1900 site elevation. Further, the location was not in an area formerly occupied by a slip. Finally, because the area did not need to be excavated for the Phase III lift excavations and surveys, the area was used to receive fill as the higher areas were excavated and surveyed. It had been covered with this excavated material prior to the initiation of the grubbing and clearing task. As a result, it also was not surveyed in the course of the surveys conducted as part of the clearing and grubbing task.

Recently, this area was used to stage an imported soil stockpile. A soil stockpile of approximately 5,000 cubic yards is located so as to cover this area. Thus, at present, it is not possible to conduct a 5-meter walkover gamma survey to fill in the unsurveyed area. It is proposed to provide that survey when the opportunity is available upon the relocation of the soil stockpile.

4.4 Granite Paving Stones and Elevated Gamma Counts

In the course of the surveys under Phase III, lift excavation surveys encountered a former roadway at the site that was paved with paving stones. The location where these stone pavers were encountered showed gamma readings of approximately 20,000 counts per minute (cpm). This was the gamma count threshold for indicating an exceedance of the 7.1 pCi/g cleanup level.

In that naturally occurring minerals in granite and other stones used in construction can contain radioactive elements, but not require management as radiologically impacted, an effort was made to assess whether the gamma counts were from the paving stones or from contamination surrounding the stones. The layer of stones was removed and stockpiled, and the underlying soil surveyed. The gamma count dropped to background levels of approximately 6,000 to 7,000 cpm. The pile of stones was then surveyed and found to be on the order of 20,000 counts, indicating the stones were the source of the elevated gamma counts. USEPA was advised of this, and a request was made to not dispose of these stones as contaminated. USEPA verbally concurred (December 13, 2002 communication with Mr. Fred Micke) that based on the evidence provided, the paving stones could be left on-site as not contaminated. A letter to the USEPA to this effect is included as Appendix G.

5.0 ANALYTICAL RESULTS

5.1 Soil Sample Radiological Analytical Results

5.1.2 Progress Excavation Soil Samples

Soil samples were collected and submitted for on-site laboratory NUTRANL analysis to document the concentrations of the target cleanup radionuclides in the material being excavated. Samples in this group of analyses ranged from materials below cleanup levels to materials well above the cleanup threshold. The maximum activity measured using the NUTRANL system was 360,000 pCi/g total radium. These progress evaluation samples were used as a confirmation of the field survey results. These samples were collected throughout the progress of the Phase II and III excavation work. The NUTRANL analyses are presented in Appendix H, first by laboratory number which is also a chronological catalogue, and then by location coordinates.

Samples were also submitted for radiological analysis to an off-site laboratory, RSSI in Morton Grove, Illinois. Those analyses were performed by high resolution gamma spectroscopy. At the request of USEPA, the analyses were performed using a Library Energy Tolerance of 1.2 and a Gamma Fraction Limit of 71 percent. Those data are also presented in Appendix H.

5.1.3 *Imported Soil Samples*

In accordance with the Work Plan, imported soil was to be subject to radiological analysis. Analyses were to be conducted, at a minimum, on each 10,000 cubic yards imported or for each separate source of borrow. The site did not import soil until near the end of the Phase III survey work, as most of the site had to be excavated for the lift surveys, and no area was available for stockpiling soil. The 5,000 cubic yard currently on-site represents the only imported soil as of the completion of the Phase III work. The radiological analysis for that material is also provided in Appendix H.

5.1.4 Pre-Verification Samples (Phase II, III Exclusion Zones)

The process of verification of remediation of the exclusion zones under Phases II and III involved the collection and analysis of pre-verification samples to confirm the removal had achieved the required cleanup levels. These samples were collected and analyzed before notifying USEPA to conduct its

verification surveys and sampling. The results of the pre-verification samples are included in a separate section of Appendix H.

5.1.5 Phase III Confirmation Samples (Base of Lift Surveys)

The Phase III lift excavations removed the overlying fill to an elevation approximately 18 inches above the site elevation circa 1900. In that these areas did not, for the most part, exhibit elevated radioactivity, there were relatively few exclusion zones, and USEPA did not perform verification surveys for these areas. In order to provide confirmation of the absence of radiological impacts, these areas were sampled on 100 foot grids, and confirmation analyses run at the on-site NUTRANL system. These data showed no evidence of elevated radioactivity and are included in Appendix H.

5.1.6 USEPA Verification Samples

USEPA conducted verification surveys and collected verification samples for each exclusion zone identified in Phase II and III. These verification samples were composites of five locations for each exclusion zone area to a maximum of 100 square meters. The five samples forming the composite from each area were then homogenized and five sub-samples were prepared. Those sub-samples were placed in 20 ml vials and analyzed at the NUTRANL on-site laboratory. The analytical results for these sub-samples were used to verify that the cleanup levels had been met, and the closure of each area was then signed off by USEPA. The results of these USEPA verification samples are included in Appendix H. The samples are scheduled to be transferred to USEPA under chain-of-custody for analysis at its contract laboratory. Those data will be included in Appendix I upon completion of the analysis and receipt of the data from USEPA.

5.1.7 Off-Site Laboratory Gamma Spectroscopy Results

Off-site laboratory analyses were provided on approximately five percent of the analyses, to confirm the results from the on-site NUTRANL analyses. These analyses were provided through RSSI of Morton Grove, Illinois. The analyses were performed by high resolution gamma spectroscopy, and used the 71% Gamma Fraction Limit and 1.2 Library Energy Tolerance in accordance with USEPA specifications. These analyses are included in Appendix H.

5.2 Air Monitoring Analytical Results

5.2.1 Site Perimeter Air Monitoring

Perimeter air monitoring for airborne radioactivity was required whenever excavation of radiologically impacted material was being conducted. This monitoring occurred during the Phase II removal and during remediation of the exclusion zones identified during Phase III.

The Lakeshore East site is sufficiently large that the monitoring of the site perimeter would not characterize the potential airborne contaminants from work at discrete locations within the site. For the Phase II removal in Slip E, the south slip, the area to be remediated was sufficiently small that air monitoring locations were established and remained at those locations for the duration of the removal effort. The monitoring locations were approximately the mid-point of the slip grid boundaries in Slip E. Figure 6 shows the area covered by the air monitoring in the south slip, Slip E. In Slip D, the north slip, the locations to be remediated were sufficiently widespread so as to require the air monitoring stations to be positioned at several locations within the Slip D grid network to be within the 200 feet of the active excavation required by the air monitoring plan. Figure 6 also shows the area monitored in Slip D. Similarly, the widespread distribution of the exclusion zones for the Phase III activities necessitated that area air monitoring equipment be repositioned for each excavation to comply with the air monitoring plan.

The air samples were analyzed the day after the collection and again after four days to allow for the short-lived progeny to decay. No exceedances of the exposure limit for the site perimeter were documented for any day of monitoring. Perimeter air monitoring results are provided in Appendix J.

5.2.2 Personal Air Monitoring

Personal air monitoring (PAM) was conducted for all persons working in exclusion zones and those persons involved in the directing of the loading of material into shipping containers. Additionally, PAMs were utilized for persons involved in the lift surveys under Phase III work, regardless of whether there was evidence of radiologically impacted material. PAM data for radioactivity for both one-day and four-day analyses are included in Appendix J. These data show no exceedances of the allowable exposure limits for this project. Note that additional personal monitoring results are provided in Section 5.5 regarding personnel radiation badge results.

5.3 Field Gamma Survey Results

Field gamma surveys were conducted for any soil excavation where there was potential for radiologically-impacted soil to be buried. This included all areas of the site where there was greater than 18 inches of cover over the site elevation in 1900. That 1900 elevation was established at 6.0 CCD (STS report 32193-YH, January 8, 2002). The following sections describe the specific surveys conducted as part of site excavation activities.

5.3.1 Phase II Exclusion Zones

The Phase II excavations were the first part of the removal effort, and consisted of the removal of the previously identified radiologically-impacted soil. In that these excavations were limited to areas where radiologically-impacted material was known to be present, each of these excavations comprised an exclusion zone. Gamma surveys were conducted throughout those excavations to assess whether the excavation had reached clean limits. In addition to the gamma surveys, samples were periodically collected and analyzed to confirm the gamma survey findings. Those analytical results are presented in Appendix H. Figure 5 identifies the locations where impacted material had been identified prior to the removal effort. Figure 8 shows the limits of the exclusion zones following the completion of the Phase II effort.

5.3.2 Phase III Lift Surveys

The Phase III excavation work consisted of excavating the fill soil above elevation 7.5 CCD, which is 18 inches above the site elevation in 1900. The areas subject to this Phase III excavation are shown on Figure 9. In that the radiologically impacted soil may be shielded by a soil cover of more than approximately 18 inches, these Phase III excavations were conducted in 18-inch lifts.

At each 18 inch lift, a survey was conducted to document the gamma readings. These gamma surveys were conducted over a 200 X 200 foot grid laid out on the site construction grid coordinate system. These grids were subdivided into quarters lettered A, B, C, and D in a clock-wise direction from the northwest corner. This grid system is shown on Figure 7.

A maximum gamma reading was recorded for each grid quarter for those areas where there was lift excavations conducted. These grid lift maps are provided in Appendix K. In addition, when the

excavation reached the base of the lowest lift, samples were collected for NUTRANL analysis from the four quarters of each grid to document the activity of the soil at that elevation. These data are in addition to the gamma survey data and are presented in Appendix H.

5.4 Equipment Release Surveys

Excavating equipment used in the excavation of radiologically-impacted soil was required to be surveyed to confirm they were free of radiological impacts prior to being released from the site. This equipment was limited to the excavation buckets used to excavate and load the impacted material. The remainder of the excavator equipment was not used within the exclusion zones. However, to confirm the absence of impacts the treads and other portions of the equipment where soil had accumulated were surveyed for contamination. For the excavator buckets, wipes were also taken in accordance with SOP 345, and alpha counts were made to confirm the absence of contamination. These survey results are presented in Appendix L.

Several locations were identified where impacted soil above the cleanup level was encountered. Those locations were marked as exclusion zones, the impacted soil was removed to clean limits, verification surveys were conducted by USEPA, and sign off was obtained for each location. The locations of the exclusion zones detected and remediated under Phase III are presented on Figure 10.

5.5 Personnel Radiation Badge Results

Personnel on site for extended periods during removal operations, and particularly personnel operating in the exclusion zones conducting gamma surveys or sampling, personnel assisting with the loading of the containers, and other persons potentially in contact with radiologically-impacted material were monitored with Optically Stimulated Luminesence (OSL) film badges. Badges were changed each calendar month. No exceedances of the allowable exposures were measured for any personnel on this project. The results of the film badge monitoring are presented in Appendix M. No exceedances of the exposure limit for the site were measured for this project.

6.0 CONCLUSION

6.1 Work Completed in Accordance With Approved Work Plan

The work at the Lakeshore East site under the Phase II and III removal and monitoring efforts has been completed in accordance with the Work Plan approved by USEPA. Any modifications of the work from the specifications in the Work Plan have been approved by USEPA.

6.2 No Known Radiological Impacted Material Remains

The work completed at the Lakeshore East site included obtaining verification sign off from USEPA for surveys of all of the areas on site where radiologically impacted soil had been identified. The removal of all identified impacted soil and the survey of those portions of the site where fill was sufficiently thick to shield potentially impacted soil from detection results in there being no areas on site where radiologically-impacted soil might remain, with the potential exception of at depths in the slips. Those areas formerly occupied by the slips (Figure 4) are sufficiently deep so as to preclude confirmation that no radiological material remains below the water table. As a result, any excavation that may disrupt historical fill in those areas will require radiation monitoring of the excavation and appropriate management of any impacted soil encountered. The monitoring and management of impacted fill/soil will be conducted in accordance with the Work Plan.

The work completed under the Work Plan and as reported in this Completion Report documents that no known material remains on the site, with the potential exception of a wick drain location in the southern slip where a small quantity of subsurface spoil (< 1 cubic foot) was observed to have slightly elevated gamma readings. As explained in detail in Section 2.3.3 of the Addendum to the Completion Report (STS, November 2004), it is possible that the elevated gamma readings were attributable to the ash and brick fragments present in the fill. The area is located a 174 feet west of the eastern property boundary along Harbor Drive and 109 feet north of the southern property boundary along 400 East Randolph. Additionally, surface gamma surveys were completed in the former slips areas, but lift excavation surveys were not conducted as explained in Section 2.4. Thus, the former slip areas remain subject to institutional controls that require surveying in accordance with the Work Plan whenever subsurface soils (below 18 inches) are disturbed in the former slip areas.

6.3 Request Completion Letter Without Use Restrictions, Except in Slips Where Monitoring Requirement Continues

On the basis of the Removal Action being completed in accordance with the Work Plan approved by USEPA, and the verification by USEPA that no radiologically-impacted material remains in excess of the cleanup criteria as specified in the Work Plan, areas as described above, STS, on behalf of Lakeshore East LLC, requests that USEPA issue a Notice of Completion for the site confirming that (a) all identified radiologically-impacted materials with levels of radioactivity in excess of the cleanup standards set forth in the Work Plan have been removed from the site as required by the Work Plan, (b) that with the exception of work in the slip areas where monitoring will continue to be required, no further investigation, removal or cleanup action is required with respect to the radiologically-impacted materials, and (c) construction and development work on the site may proceed without further regulatory requirements relating to radiological impacts, except were subsurface historical fill soils below a depth of 18 inches will be disturbed within the boundaries of the former slip areas.

APPENDIX I

USEPA Contract Laboratory Analytical Data

APPENDIX N

Shipping Manifests